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(71) Applicant *(for all designated States except US)*: SCAPA GROUP PLC [GB/GB]; Oakfield House, 93 Preston New Road, Blackburn, Lancashire BB2 6AY (GB).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: SAYERS, Ian, Christison [GB/GB]; 30 Chesterbrook, Ribchester, Nr. Preston, Lancashire PR3 3XT (GB). JEFFERY, John [GB/GB]; 65 Royshaw Avenue, Blackburn, Lancashire BB1 8RJ (GB).

(74) Agents: QUEST, Barry et al.; Wilson Gunn M'Caw, 41–51 Royal Exchange, Cross Street, Manchester M2 7BD (GB).

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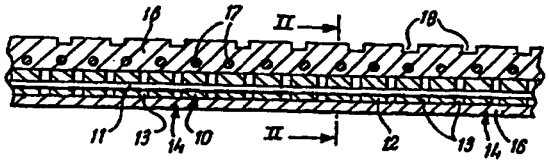

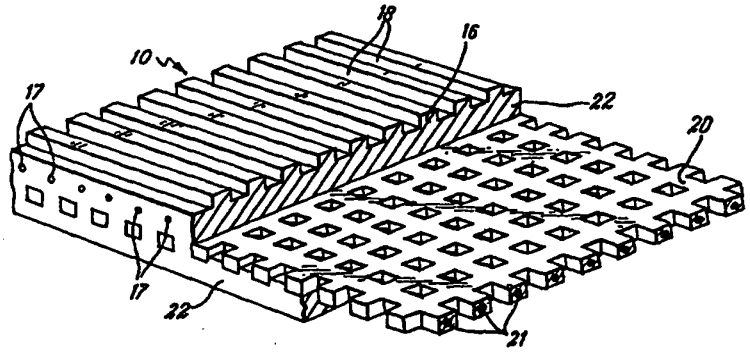

(57) Abstract

An extended nip press belt comprises a plurality of strips (14) each formed of a matrix of plastics (12) having perforations (13) to form a mesh or perforated membrane, and having reinforcing yarns (11) extending along the strips. The strips (14) are arranged in edge contact side by side across the width of the belt and their edges fused together along joints (15). The layer formed is embedded in a further matrix (16) containing further reinforcing yarns (17) at right angles to the yarns (11) and thus in the machine direction of the resulting belt.

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IMPROVEMENTS IN EXTENDED NIP PRESS BELTS

This invention relates to improvements in extended nip press belts.

Extended nip dewatering presses are used in the press section of the paper making process, following forming of the paper web on a forming wire, to remove excess water from the paper web before the paper web is passed to a drying stage of the paper making process. In an extended nip press of a paper making machine, the paper web is in intimate contact with one or two moisture-absorbing felts, moves in pressure contact with a press roll and is urged into such contact by a pressure shoe acting through a belt in contact with the outermost (in relation to the press roll) of the moisture absorbing felts.

The belt is used to provide a low or zero friction passage of the web and felt(s) through the nip. These belts generally comprise structured reinforcing yarns or a membrane which may be perforated, embedded in a matrix of a suitable plastics material and may be provided with ribbing for example on the surface which contacts the press felt to form grooves which carry away water squeezed from the paper web and the press felt in the nip.

Examples of such belt constructions are given in WO 92/02677 wherein a membrane which is effectively a mesh of machine-direction and cross machine direction strips and incorporating machine direction reinforcement yarns is embedded in a matrix of a thermoset polyurethane material, which extends through the apertures in the membrane and forms layers above and below the membrane. In WO 95/25200, two mesh membranes may be overlayed, with the strips of one membrane being set at an angle relative to those of the other so that the grid of one membrane is set on the machine direction and cross machine axes, whilst the grid of the other is set obliquely

to the machine direction.

In GB-A-2202873 a non-woven fabric is disclosed which is applicable to a range of uses, including a press felt substrate, wherein the fabric is cast in strips having reinforcing yarns extending longitudinally of the strips, and holes formed in the membrane by means of teeth on the casting surface. CA-A-2068800 indicates that it is known to form a press belt from overlaid strips which cross each other both being arranged obliquely relative to the machine direction but at opposed angles and discloses a variant wherein strips are overlaid at a small oblique angle to the machine direction of the order of 2°-5°, the strips in the upper layer being offset by half a strip width with respect to the strips of the lower layer. This belt is considered to lack cross-directional rigidity and the strips are made by a slow and cumbersome weaving technique.

It is also known from US 5134010 (Voith) to form a press belt using both machine direction and cross-machine direction yarns in a synthetic material matrix such as polyurethane.

Spiral-link reinforced belts have been proposed, eg incorporating a spiral link substrate of cross-machine direction connecting wires, about which are looped flattened helical coils linking each respective pair of wires and interdigitated with the next adjacent coils embedded in a suitable plastics matrix. These have proven to be problematical due to poor bonding between the polyurethane matrix and the polyester spiral link fabric. The only alternative materials for making spiral link fabrics PEEK and PPS are however too expensive to be considered a viable option for solving this problem of incompatibility.

An object of this invention is to provide a new extended nip press belt which

achieves a much greater bonding between the matrix material and the reinforcing structure or membrane.

According to the invention a press belt comprises a coarse mesh composite membrane comprising reinforcing yarns extending in at least one direction in a plastics matrix, the membrane being formed as or into strips and the strips being joined along their longitudinal edges, the strips being arranged such that the reinforcing yarns extend substantially in the cross machine direction of the belt and embedded in a further matrix also including further reinforcing yarns extending substantially in the machine direction of the belt.

The invention also comprises a method of manufacturing a press belt, comprising forming a coarse mesh composite membrane incorporating reinforcing yarns extending in at least one direction in a plastics matrix, forming the membrane into or as strips with the reinforcing yarns extending longitudinally of the strips, joining the strips along their longitudinal edges, the strips being arranged such that the reinforcing yarns extend substantially in the cross-machine direction of the belt and feeding matrix polymer to cast the strips with further reinforcing yarns extending in substantially the machine direction of the belt.

The strips may be formed by melting their longitudinal edges and allowing the edges to fuse together and then cooled to allow the fused regions to set.

The matrix polymer of the strips and/or the completed felt is preferably polyurethane and the reinforcing yarns may be multi filament yarns selected from for example polyester, polyamide, PEEK, PPS, PBO, aramid, glass, carbon or steel. However, monofilament, or twisted, braided or plied yarns may be used. Some or all of the yarns may be coated, for example with an elastomer such as TPU.

A preferred embodiment of a press belt according to the invention and method for its manufacture will now be further described by way of example with reference to the accompanying drawings wherein:-

Fig.1 is a diagrammatic sectional view of a press belt according to the invention on a line perpendicular to the machine direction;

Fig.2 is a diagrammatic sectional view of the press belt of fig.1 on a line parallel to the machine direction, i.e on line II-II of fig.1;

Fig.3 is a perspective view of part of a first form of belt substrate;

Fig.4 is a similar view of a second form of belt substrate;

Fig.5 is a detail of apparatus for use in edge to edge joining of strips of belt substrate according to any of fig.3 or fig.4; and

Fig.6 is a diagram of a machine for subsequently coating the resulting belt fabric with a further matrix and reinforcing yarns.

In the drawings, figs.1 and 2 are diagrammatic sections, substantially at right angles to each other, through a completed press belt fabric according to the invention.

The press belt comprises a substrate or support layer 10, comprising a plurality of reinforcing yarns 11 extending substantially in the cross machine direction, wherein a matrix 12 of polyurethane, which has an array of apertures 13 which may be formed by casting the layer 10 on a studded or pinned drum, as known for example from GB-A-2202893. The layer 10 is either divided into a plurality of strips, or cast in the form of strips 14 which as shown in fig.2 are laid side by side, extending across the width of the belt, and their edges are joined by melting together to form fusion joints 15.

The layer 10 is then covered or embedded in a further matrix 16, in which are embedded further reinforcing yarns 17, which run approximately at right angles to the

reinforcing yarns 11 in the support layer 10, that is extending in the machine direction longitudinally of the finished belt. The upper surface of the matrix 16 may, in known manner, be provided with grooves 18 to lead expressed water away from the nip.

Fig. 3 illustrates one form of substrate 10 useable in the invention substantially according to WO 92/02677, wherein a grid or mesh membrane 20, comprises longitudinal and transverse members with included apertures. This membrane 20 also has reinforcing yarns 21 extending along one set of the longitudinal or transverse members, and the grid is set in a matrix 22 of eg polyurethane which extends substantially above and below the membrane.

Fig.4 illustrates a fragment of another form of membrane 30, with reinforcing yarns 31 embedded in a plastics matrix 32, and having circular holes 33 extending through the membrane 30 from one face to the other. This membrane is substantially as described in GB-A-2202893, without the fibrous batt layer added in that disclosure.

The membrane, eg according to fig.3 or fig.4 is either formed as strips or cut into strips and then laid circumferentially about a form 40 with pins 41 to enter holes such as 31 in the membrane eg as in fig.5 and abutting edge regions are melted and fused with the addition of further polymer to join the edges together thereby fabricating a continuous belt composed of an array of such strips extending widthwise across the belt, joined edge to edge.

After formation of the belt substrate it is placed on a further machine as in fig.6 to cast a matrix layer over the substrate. The substrate is passed as a continuous belt over end rollers 60, 61 one of which 60 is adjustable to vary tension. On the upper pass of the belt, a plurality of reinforcing yarns 62 are fed in the direction of belt travel from a supply 63 onto the upper surface of the substrate. Matrix material 64 such as

polyurethane is fed onto the belt between moulding belts 65 and 66 to embed the yarns 62 and encapsulate the substrate and reinforcing yarns in a matrix to provide a structure of the type illustrated in figs. 1 and 2 above.

The matrix polymers are typically polyurethane and the reinforcing yarns may be multifilament yarns such as polyester, nylon, PEEK, PPS, PBO, aramid, glass, carbon or steel, although monofilament yarns or even twisted, braided or plied yarns may be used. At least some of the yarns may be coated, preferably with an elastomer such as TPU.

Press belts made by the method of the invention have a number of advantages including improved delamination and crack resistance due to improved bonding between the polyurethane matrix and the polyurethane or TPU membrane, in addition to optimised bonding between the matrix and the added running direction reinforcing yarns. Regular structure is also maintained due to there being no sagging of the cross-direction yarns.

The reinforcing structure can be closer to the centre of the belt for better strength properties and for protection against wear from the presser shoe side of the belt. A monocoque, fully encapsulated reinforcing structure is obtained to protect against wear, eliminate air bubble formation and improve delamination resistance.

There are no woven components present in the belt structure, and the large open area of the coarse mesh membrane allows monocoque casting of the matrix polymer. The added running direction reinforcing yarns lie on the opposite side of the base to the press shoe, so that belts do not have to be turned inside out after manufacture. Belts with reinforcing yarns on the shoe side have been shown to be much more prone to losing these yarns, which tend to work their way through the

enveloping matrix at the back of the belt.

Finally the belt construction described obtains a good cross-directional rigidity and running direction strength.

CLAIMS

1. A press belt comprising at least one coarse mesh composite membrane comprising first reinforcing yarns extending in at least one direction in a plastics matrix, the membrane being formed as or into strips and the strips being joined along their longitudinal edges, the strips being arranged such that said first reinforcing yarns extend substantially in the cross machine direction of the belt and embedded in a further matrix also including at least one layer of further reinforcing yarns extending substantially in the machine direction of the belt.

2. A press belt according to claim 1, wherein the first plastics matrix and/or the further matrix are of thermosetting and/or thermoplastic materials.

3. A press belt according to claim 2, wherein said material is a polyurethane.

4. A press belt according to claim 1, 2 or 3 wherein said first reinforcing yarns and/or said further reinforcing yarns are multifilament yarns made from a material selected from polyester, polyamide, PEEK, PPS, PBO, aramid, glass, carbon or steel.

5. A press belt according to claim 1, 2 or 3 wherein said first, and/or said further, reinforcing yarns comprise monofilament, twisted, braided or plied yarns.

6. A press belt according to claim 4 or 5 wherein at least some of said reinforcing yarns are coated with an elastomer.

7. A press belt according to any preceding claim wherein the membrane is perforated.

8. A press belt according to any preceding claim wherein said further matrix is provided on both sides of the membrane and extending through the membrane apertures to provide a monocoque structure.

9. A press belt according to any preceding claim wherein the paper side of the

matrix is provided with grooves.

10. A press belt according to claim 1, wherein the membrane and said further reinforcing yarns are oriented at an oblique angle of 1-5° to each other.

11. A press belt according to claim 9 wherein said grooves extend in the machine direction of the belt.

12. A method of manufacturing a press belt, comprising forming at least one coarse mesh composite membrane incorporating reinforcing yarns extending in at least one direction in a plastics matrix, forming the membrane into or as strips with the reinforcing yarns extending longitudinally of the strips, joining the strips along their longitudinal edges, the strips being arranged such that the reinforcing yarns extend substantially in the cross-machine direction of the belt and feeding matrix polymer to cast the strips with at least one layer of further reinforcing yarns extending in substantially the machine direction of the belt.

13. A method according to claim 12, wherein the matrix polymer and said further reinforcement yarns are cast simultaneously onto the joined strips.

14. A method according to claim 12, wherein the matrix polymer and said further reinforcement yarns are cast one after the other onto the joined strips.

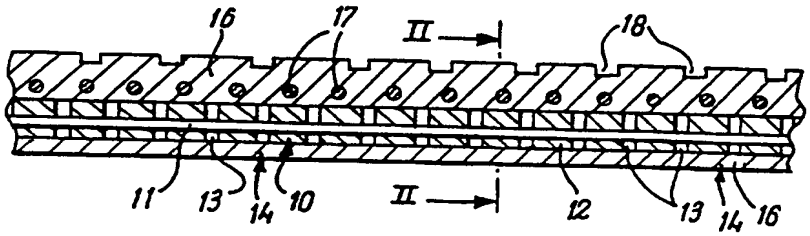

FIG. 1

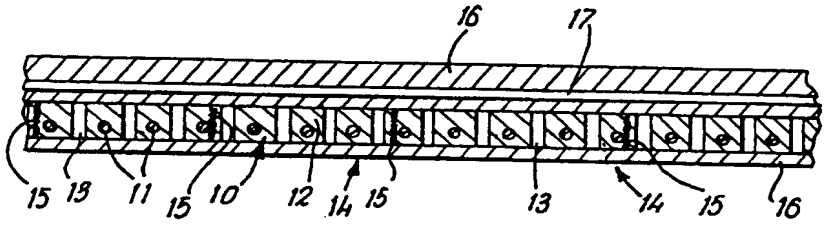

FIG. 2

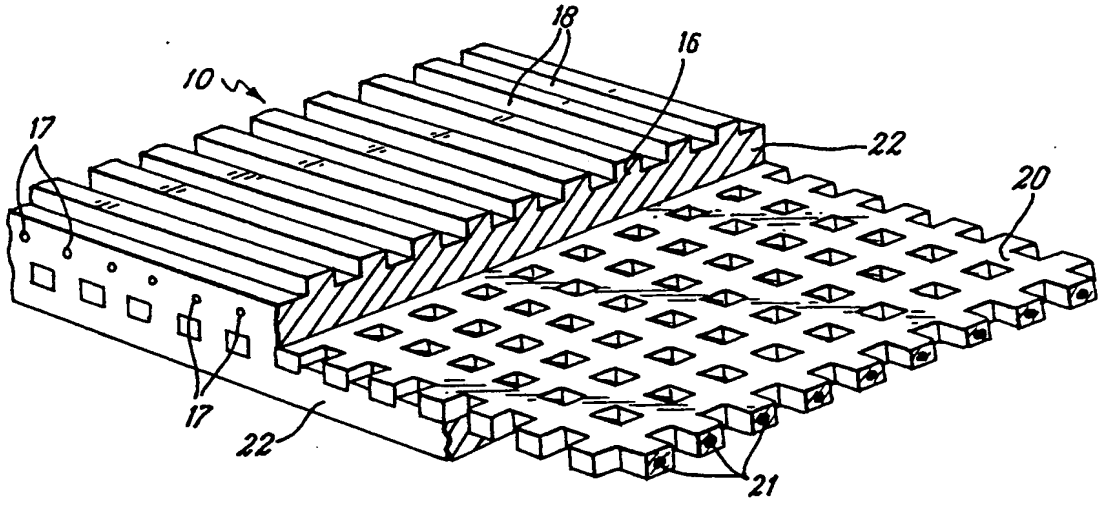

FIG. 3

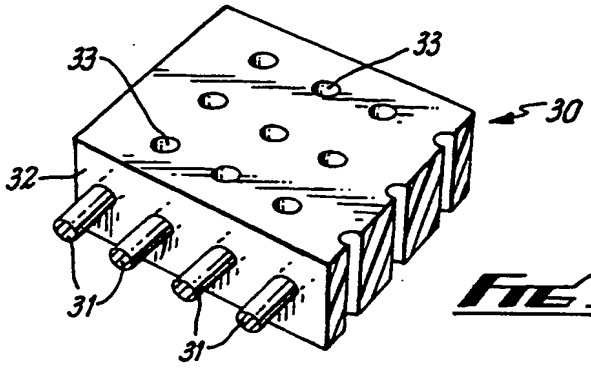

FIG.4

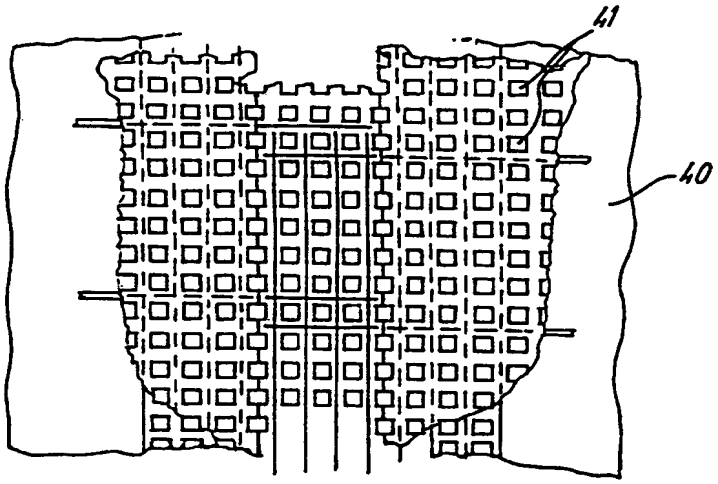

FIG.5

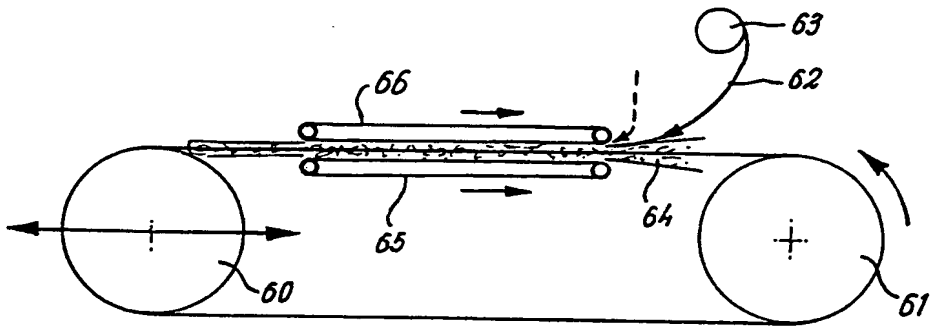

FIG.6

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/GB 98/02735

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 D21F3/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 92 02677 A (SCAPA GROUP) 20 February 1992 cited in the application	
A	GB 2 287 484 A (SCAPA GROUP) 20 September 1995 cited in the application	
A	DE 43 40 344 A (VOITH) 7 April 1994	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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18 December 1998	04/01/1999

Name and mailing address of the ISA	Authorized officer
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...ormation on patent family members

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